WHAT IS CLAIMED IS:

1. An exposure apparatus for transferring a pattern of a mask onto a workpiece, comprising:

a light source;

an illumination optical system, which illuminates said mask, arranged in an optical path between said light source and said mask and comprising a pupil shape forming unit which forms four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil thereof,

wherein said four planar light sources are arranged at each substantial vertices of a narrow rectangle whose barycenter is located on the optical axis so as to adjust a resist pattern to be transferred or a substrate pattern formed via a process to a predetermined size and a predetermined shape; and

a projection optical system arranged in an optical path between said mask and said workpiece.

2. The exposure apparatus according to claim 1, wherein said mask is provided with an optical proximity correction, and said pupil shape forming unit is capable of changing the shape of the narrow rectangle so as to further correct at least one of the longitudinal line width and a transverse line width of the resist pattern which is obtained from said mask with the optical proximity correction.

3. The exposure apparatus according to claim 1,

wherein a ratio between longer side and shorter side of said rectangle is 1.1 or more.

4. The exposure apparatus according to claim 1, wherein each of said four substantially planar light sources has circular shape.

5. The exposure apparatus according to claim 1, wherein said pupil shape forming unit has an aperture stop, disposed on the illumination optical path, that restricts a light beam passing therethrough.

6. The exposure apparatus according to claim 5, wherein said pupil shape forming unit has a plurality of aperture stops which are removable from and insertable in the illumination optical path.

7. The exposure apparatus according to claim 1, wherein said pupil shape forming unit has a diffractive optical element, disposed on the illumination optical path, which converts a light beam into a light beam with a predetermined cross section.

8. The exposure apparatus according to claim 7, wherein said pupil shape forming unit has a plurality of diffractive optical elements which are removable from and insertable in the illumination optical path.

9. An exposure apparatus for transferring a pattern of a mask onto a workpiece, comprising:

a light source;

an illumination optical system, which illuminates

said mask with a plurality of chip patterns to be transferred, arranged in an optical path between said light source and said mask and comprising a pupil shape forming unit which forms four substantially planar light sources at a predetermined plane orthogonal ton the illumination optical path in the vicinity of the pupil thereof,

wherein said four planar light sources are arranged at each substantial vertices of a narrow rectangle whose barycenter is located on the optical axis,

and at least one of a longer side of said narrow rectangle and a shorter side of said narrow rectangle is set based on a longer direction of said chip pattern; and

a projection optical system, which projects and transfers the chip patterns of the mask onto said workpiece, arranged in an optical path between said mask and said workpiece.

10. The exposure apparatus according to claim 9, wherein said pupil shape forming unit adjusts the four planar light sources so as to set a resist pattern to be transferred or a substrate pattern formed via a process to a predetermined size and a predetermined shape.

11. The exposure apparatus according to claim 9, wherein said pupil shape forming unit is capable of changing the shape of the narrow rectangle so as to further correct at least one of the longitudinal line width and a transverse line width of the resist pattern or the substrate pattern

which is obtained from the mask with the optical proximity correction.

12. The exposure apparatus according to claim 9, wherein a ratio between longer side and shorter side of said rectangle is 1.1 or more.

13. The exposure apparatus according to claim 9, wherein each of said four substantially planar light sources has circular shape.

14. The exposure apparatus according to claim 9, wherein said pupil shape forming unit has an aperture stop, disposed on the illumination optical path, which restricts a light beam passing therethrough.

15. The exposure apparatus according to claim 14, wherein said pupil shape forming unit has a plurality of aperture stops which are removable from and insertable in the illumination optical path.

16. The exposure apparatus according to claim 9, wherein said pupil shape forming unit has a diffractive optical element, disposed on the illumination optical path, which converts a light beam into a light beam with a predetermined cross section.

17. The exposure apparatus according to claim 16, wherein said pupil shape forming unit has a plurality of diffractive optical elements which are removable from and insertable in the illumination optical path.

18. A method of exposure comprising the steps of:

illuminating a mask with a pattern to be transferred through an illumination optical system, having a step of:

forming four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil of the illumination optical system; and

adjusting the pattern projected onto the workpiece or a substrate pattern formed via a process as a desired size and shape by arranging said four planar light sources at each substantial vertices of a narrow rectangle whose barycenter is located on an optical axis; and

projecting and transferring the pattern of the mask onto a workpiece.

19. The method according to claim 18, wherein the mask is provided with an optical proximity correction, and the method further comprising a step of changing the shape of said narrow rectangle so as to further correct at least one of the longitudinal line width and a transverse line width of the resist pattern which is obtained from said mask with the optical proximity correction.

20. The method according to claim 18, wherein a ratio between longer side and shorter side of said rectangle is 1.1 or more.

21. The method according to claim 19, wherein a ratio between longer side and shorter side of said rectangle is 1.1 or more.

22. A method of exposure comprising the steps of:

illuminating a mask with a plurality of chip patterns through an illumination optical system, having the steps of:

forming four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil of the illumination optical path; and

arranging said four planar light sources at each substantial vertices of a narrow rectangle whose barycenter is located on the optical axis, wherein at least one of the longer side of said narrow rectangle and shorter side of said narrow rectangle is set based on a longer direction of said chip pattern; and

projecting and transferring the chip patterns on this mask onto a workpiece.

23. The method according to claim 22, wherein said illuminating process having a step of setting the four planar light sources so as to set a resist pattern to be transferred or a substrate pattern formed via a process to a predetermined size and a predetermined shape.

24. The method according to claim 22, wherein said mask is provided with an optical proximity correction, and the method further comprising a step of changing the shape of said narrow rectangle so as to further correct at least one of a longitudinal line width and a transverse line width

of the resist pattern or the substrate pattern which is obtained from the mask with the optical proximity correction.

25. The method according to claim 22, wherein a ratio between longer sides and shorter sides of said rectangle is 1.1 or more.

26. An exposure apparatus comprising:

a light source;

an illumination optical system, arranged in an optical path between said light source and a mask with a pattern to be transferred, that illuminates the mask, and comprising a pupil shape forming unit which forms four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil thereof; and

a projection optical system, arranged in an optical path between said mask and a workpiece, which projects and transfers the pattern of said mask onto the workpiece, and

wherein said pupil shape forming unit has a first illumination mode and a second illumination mode for arranging said four planar light sources,

in said first illumination mode, said four planar light sources are arranged at each substantial vertices of a narrow rectangle having barycenter located on the optical axis, longer sides arranged along a predetermined direction, and a ratio between longer side and shorter side of the narrow rectangle of 1.1 or more,

and

in second illumination mode, said four planar light sources are arranged at each substantial vertices of another narrow rectangle having barycenter located on the optical axis, shorter sides arranged along said predetermined direction, and a ratio between shorter side and longer side of 1/1.1 or less.

27. The exposure apparatus according to claim 26, wherein the ratio between longer side and shorter side of said rectangle in said first illumination mode is 1.2 or more, and wherein the ratio between shorter side and longer side of said another rectangle in said second illumination mode is 1/1.2 or less.

28. The exposure apparatus according to claim 26, wherein a ratio σs between the respective numerical apertures of the four light beams from said four substantially planar light sources and the numerical aperture on the mask side of said projection optical system is within the range of 0.1 and 0.3 inclusive.

29. The exposure apparatus according to claim 27, wherein a ratio σs between the respective numerical apertures of the four light beams from said four substantially planar light sources and the numerical apertures on the mask side of said projection optical system is within the range of 0.1 and 0.3 inclusive.

30. A method of exposure comprising the steps of:

illuminating a mask with a pattern through an illumination optical system; and

projecting and transferring the pattern on the mask onto a workpiece,

wherein said illuminating step comprising the steps of:

forming four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of a pupil of the illumination optical system; and

arranging said four substantially planar light sources on said predetermined plane as a first or second illumination mode,

in said first illumination mode, said four planar light sources are arranged at each substantial vertices of a narrow rectangle having barycenter located on the optical axis, longer sides arranged along the predetermined direction, and a ratio between longer sides and shorter sides of 1.1 or more, and

in second illumination mode, said four planar light sources are arranged at each substantial vertices of another narrow rectangle having barycenter located on the optical axis, shorter sides arranged along said predetermined direction, and a ratio between shorter sides and longer sides of 1/1.1 or more.

31. The method according to claim 30, wherein the

ratio between longer side and shorter side of said rectangle in said first illumination mode is 1.2 or more, and wherein the ratio between shorter side and longer side of said another rectangle in said second illumination mode is 1/1.2 or less.

32. The method according to claim 30, wherein a ratio σs between the respective numerical apertures of the four light beams from said four substantially planar light sources and the numerical apertures on the mask side of the projection optical system is within the range of 0.1 and 0.3 inclusive.

33. The method according to claim 31, wherein the ratio σs between the respective numerical apertures of the four light beams from said four substantially planar light sources and the numerical apertures on the mask side of said projection optical system is within the range of 0.1 and 0.3 inclusive.

34. An exposure apparatus comprising:

a light source;

an illumination optical system, arranged in an optical path between said light source and a mask with a pattern to be transferred, which illuminates said mask; and

a projection optical system, arranged in an optical path between the mask and a workpiece, which projects and transfers the pattern of said mask on said workpiece,

wherein said illumination optical system comprises a pupil shape forming unit, arranged in an illumination optical path, which forms four substantially planar light

sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil thereof, and arranges said four substantially planar light sources at each substantial vertices of a narrow rectangle whose barycenter is located on the optical axis as first and second illumination modes,

in said first illumination mode, one barycenter position of said four substantially planar light sources (r, θ) in polar coordinates whose origin is located at illumination optical axis, and r is normalized with a pupil radius of the projection optical system as 1, is satisfied following conditions,

$$0.5 < r < 1 - rs$$

$$\sin^{-1}\{(rs)/(1 - rs)\} < \theta < \pi/4$$

where rs is the distance from the barycenter position of said one planar light source to the outermost circumferential edge, and

in said second illumination mode, one barycenter position of said four substantially planar light sources (r, θ) in polar coordinates whose origin is located at illumination optical axis, and r is normalized with a pupil radius of the projection optical system as 1, is satisfied following conditions,

$$0.5 < r < 1 - rs$$

$$\pi/4 < \theta < \pi/2 - \sin^{-1}\{(rs)/(1 - rs)\}.$$

35. The exposure apparatus according to claim 34,

wherein said four substantially planar light sources are arranged with second-order rotational symmetry about a center of said optical axis on said predetermined plane.

36. A method of exposure comprising the steps of;

illuminating a mask with a pattern through an illumination optical system; and

projecting and transferring the pattern on said mask onto a workpiece,

wherein said illuminating step comprising steps of:

forming four substantially planar light sources at a predetermined plane orthogonal to the illumination optical path in the vicinity of the pupil of the illumination optical path; and

arranging said four substantially planar light sources at each substantial vertices of a narrow rectangle whose barycenter is located on the optical axis as first and second illumination modes,

in said first illumination mode, one barycenter position of said four substantially planar light sources (r, θ) in polar coordinates whose origin is located at illumination optical axis, and r is normalized with a pupil radius of the projection optical system as 1, is satisfied following conditions,

$$0.5 < r < 1 - rs$$

$$\sin^{-1}\{(rs)/(1 - rs)\} < \theta < \pi/4$$

where rs is the distance from the barycenter position

of said one planar light source to the outermost circumferential edge, and

in said second illumination mode, one barycenter position of said four substantially planar light sources (r, θ) in polar coordinates whose origin is located at illumination optical axis, and r is normalized with a pupil radius of the projection optical system as 1, is satisfied following conditions,

$$0.5 < r < 1 - rs$$

$$\pi/4 < \theta < \pi/2 - \sin^{-1}\{(rs)/(1 - rs)\}.$$

37. An illumination optical apparatus comprising:

an optical integrator arranged in an illumination optical path and forming a large number of light sources on the basis of a light beam from a light source;

a guiding optical system arranged in an illumination optical path between the optical integrator and a irradiated face and directing a light beam from said optical integrator to an irradiated face;

a illumination field forming optical system, which includes a light beam converting element disposed in the optical path between said light source and said optical integrator which converts the light beam from said light source to light beam having a predetermined cross-sectional shape or a predetermined light intensity distribution, forming a illumination field with a predetermined positional relationship with respect to said optical integrator in

response to the light beam emitted from said light beam converting element;

a light splitting member disposed on the optical path between said predetermined plane and said light beam converting element;

a photoelectric converter element disposed on substantial conjugate plane of said predetermined plane and receiving light beam split by said light splitting member; and

a calculating unit, connected to said photoelectric converter element, and which determines a positional relationship between the light beam from said light source and said predetermined plane in response to the output of said photoelectric converter element.

38. The illumination optical apparatus according to claim 37, wherein said illumination field forming optical system further comprises a variable magnifying optical system which changes a size of the illumination field formed on said predetermined plane.

39. The illumination optical apparatus according to claim 37, wherein said illumination field forming optical system further comprises a first V-grooved axicon system having a ridge line extending in a first direction.

40. The illumination optical apparatus according to claim 39, wherein said illumination field forming optical system further comprises at least one of a conical axicon

system having a conical refracting surface and a second V-grooved axicon system having a ridgeline extending in a second direction orthogonal to said first direction.

41. The illumination optical apparatus according to claim 37, wherein said light beam converting element comprises a plurality of diffractive optical elements which are removable and insertable in the illumination optical path.

42. The illumination optical apparatus according to claim 41, wherein at least one of said diffractive optical elements is used for an adjustment of said illumination optical apparatus.

43. The illumination optical apparatus according to claim 37, wherein said optical integrator has a wavefront dividing optical integrator with lens elements arrayed two-dimensionally, whose incident face is disposed at the position of said predetermined plane, or a position in the vicinity thereof.

44. An exposure apparatus comprising:

the illumination optical device according to claim 37; and

a projection optical system arranged in an optical path between a mask set on the irradiated face and an image surface of the mask and transferring the pattern of the mask onto a workpiece.

45. The exposure apparatus according to claim 44,

further comprising a light beam adjusting unit disposed in the optical path between said light source and said beam splitting member and adjusting a position or direction of the light beam from said light source.

46. A method of manufacturing micro devices, comprising the steps of:

exposing the mask pattern onto a workpiece with the exposure apparatus according to claim 44; and

developing said workpiece which has been exposed by said exposing step.